

CLAIMS

- 5           1.    A de-skew system comprising:  
          a plurality of data channels over which data is  
transmitted;  
          a plurality of selectors coupled to the plurality of data  
channels; and  
10           a controller coupled to the plurality of selectors and  
configured to cause the selectors to provide data from a desired  
data channel for transmission over a forward data sample  
channel.
- 15           2.    The system of claim 1 wherein data transmitted over  
the forward data sample channel comprises a forward data sample,  
the forward data sample further including a header.
- 20           3.    The system of claim 2 wherein the header comprises a  
fixed pattern and at least one channel number.
4.    The system of claim 2 wherein the header further  
comprises sample length and status words.
- 25           5.    The system of claim 2 wherein the header precedes the  
forward data sample.
- 30           6.    The system of claim 1 further comprising:  
          a processor receiving data from the plurality of data  
channels and the forward data sample channel; and  
          a de-skew module configured to collect portions of the  
received data and to adjust collection of each of the received  
35 data based on the received forward data sample and the collected  
portions of the received data.

5           7.    A de-skew system comprising:  
             a processor configured to receive input data and generate  
             parallel data;

            a buffer unit receiving the generated parallel data and a  
             clock signal and generating a plurality of data signals based  
 10           on the received generated data and clock signal; and

            a control unit configured to collect portions of the  
             plurality of data signals and to generate a forward data sample  
             based on the collected portions of the plurality of data  
             signals.  
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            8.    The system of claim 7 further comprising:  
             de-skew units each receiving at least one of the plurality  
             of data signals and adjusting received data based on a timing  
             signal; and  
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            a control unit configured to collect portions of the  
             plurality of data signals and to generate the timing signal  
             based on the forward data sample and the collected portions of  
             the plurality of data signals.  
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            9.    The system of claim 8 further comprising input drivers  
             receiving the plurality of data signals and the forward data  
             sample and supplying the plurality of data signals to the de-  
             skew units and the forward data sample to the control unit.  
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            10.   The system of claim 9 further comprising a buffer unit  
             receiving data from the de-skew units and a clock signal and  
             generating a plurality of data signals based on the received  
             clock signal.  
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11. The de-skew system of claim 7 further comprising:

5 a delay unit receiving the forward data sample and generating a delayed forward data sample delayed by a predetermined amount of time; and

wherein the control unit receives the delayed forward data sample and generates the timing signal based on the delayed  
10 forward data sample and the collected portions of the plurality of data signals.

12. A de-skew method comprising:

receiving data from a plurality of data channels;

15 selecting a portion of data from each of the received data from the plurality of data channels; and

generating a forward data sample comprising the selected portions of data.

13. The de-skew method of claim 12 further comprising

receiving the forward data sample;

identifying the portion of data corresponding to the received data from the plurality of data channels;

25 determining a delay based on timing between the portion of data and the corresponding received data; and

passing the received data along the plurality of data channels after the determined delay.

14. A de-skew method comprising:

centering a forward data sample;

30 comparing the forward data sample to data on one of the plurality of data channels; and

35 determining a time variation between the data and the forward data sample when the forward data sample corresponds to

the data.

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15. The method of claim 14 further comprising delaying the forward data sample based on the determined time variation.

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16. The method of claim 14 wherein centering the forward data sample further comprises:

setting a sampling point of a first data channel; and  
sampling the first data channel at the set sampling point.

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17. The method of claim 14 wherein centering the forward data sample further comprises sampling the first data channel at a midpoint of a predetermined de-skew range.

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18. The method of claim 14 wherein centering the forward data sample further comprises sampling the first data channel at approximate a center of a data eye of the first data channel and near a midpoint of a predetermined de-skew range.

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19. A de-skew method comprising:  
determining a channel number for a forward data sample;  
retrieving data from a data channel identified by the channel number, the data channel being a first data channel;  
comparing the data from the first data channel with a slice of delayed data from the forward data sample; and

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adjusting timing of the forward data sample when the data from the first data channel corresponds to the slice of the delayed data.

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20. The method of claim 19 wherein adjusting time of the forward data sample comprises delaying the forward data sample

by an amount of time the slice of delayed data is delayed.

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21. A de-skew method comprising:

selecting data from specific channel of a plurality of channels;

centering skew adjustment for the specific channel;

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adjusting a forward data sample until data in the forward data sample matches the selected data;

selecting another channel of the plurality of channels;

adjusting skew on the selected channel until data in the selected channel matches the forward data sample; and

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rotating through all the plurality of channels to select and adjust skew of all the plurality of channels to match the forward data sample.

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22. The method of claim 21 further comprising:

receiving a header; and

decoding the header to determine a channel number.

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23. The method of claim 22 wherein the header comprises a fixed pattern and at least one channel number.

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24. The method of claim 22 wherein the header further comprises sample length and status words.

25. The method of claim 22 wherein the header precedes the forward data sample.

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26. The method of claim 25 where the forward data sample comprises a fixed quantity of data samples.

27. The method of claim 21 further comprising word  
5 aligning data from the plurality of channels.

28. The method of claim 21 further comprising byte  
aligning data from the plurality of channels.

10 29. The method of claim 21 wherein centering skew  
adjustment further comprises centering a sampling point of the  
selected channel.

15 30. The method of claim 21 wherein center skew adjustment  
further comprises:

sampling a plurality of points of data from the selected  
data channel; and

20 comparing the plurality of sampled points to determine a  
center of the data of the selected data channel.

31. A method of deskewing parallel data channels between  
a transmitting unit and a receiving unit using a forward sample  
channel, the transmitting unit providing data signals to the  
25 receiving unit over the parallel data channels and also  
providing sample signals to the receiving unit over the forward  
sample channel, the method comprising:

selecting a data channel for deskewing;

transmitting data over the data channel;

30 transmitting the data over the forward sample channel;

comparing received data transmitted over the data channel  
with received data transmitted over the forward sample channel;  
and

35 deskewing the data channel based on the comparison.

32. The method of claim 31 further comprising selecting  
5 a further data channel for deskewing;  
transmitting further data over the further data channel;  
transmitting the further data over the forward sample  
channel;  
comparing received further data transmitted over the  
10 further data channel with received further data transmitted over  
the forward sample channel; and  
deskewing the further data channel based on the comparison.

33. The method of claim 32 further comprising  
15 transmitting a header over the forward data sample.

34. The method of claim 33 wherein the header includes an  
indication of the selected channel.

35. The method of claim 34 wherein the header is  
20 transmitted over the forward sample channel prior to  
transmission of data for a data channel over the forward sample  
channel.

36. The method of claim 35 where deskewing is  
accomplished by adjusting a delay in the path of data received  
over the data channels in the receiving unit.

37. A method of deskewing parallel data lines comprising:  
30 providing parallel data over a plurality of parallel data  
lines, the parallel data lines providing parallel data from a  
first unit to a second unit;

35 successively providing sample data over a sample channel,  
the sample data corresponding to data of the parallel data, the

sample channel providing sample data from the first unit to the  
5 second unit; and

using the sample data to align the parallel data.

38. A system including deskew functions comprising:

an upstream unit providing parallel data to a downstream  
10 unit over parallel data channels;

a downstream unit receiving the parallel data from the  
upstream unit over the parallel data channels;

a sample channel coupling the upstream unit and the  
downstream unit, the sample channel carrying samples of the  
15 parallel data from the upstream unit to the downstream unit.

39. The system including deskew functions of claim 38  
wherein the upstream unit includes a sampler for placing samples  
20 of data from a selected parallel data line on the sample  
channel.

40. The system including deskew functions of claim 39  
wherein the downstream unit includes a deskew circuitry for each  
25 of the parallel data channels.

41. The system including deskew functions of claim 40  
wherein the downstream unit includes control circuitry providing  
30 adjustments to the deskew circuitry based on a comparison of  
portions of the parallel data and data provided over the sample  
channel.